Site File
6.4

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Technical Memorandum

To: Kevin Parrett, Project Manager-- McCormick and Baxter Superfund Site

Date: April 9, 2004

From: John Montgomery

Subject: February 26, 2004 through March 31, 2004 Barrier Wall Performance Monitoring Monthly Report

1.0 Introduction

This technical memorandum presents a monthly status report on groundwater movement and nonaqueous phase liquid (NAPL) thickness results inside and outside the barrier wall at the McCormick and Baxter Creosoting Company, Portland Plant (McCormick and Baxter) site in Portland, Oregon. The technical memorandum presents hydraulic head measurements and gradients, groundwater contour maps, transducer plots, NAPL gauging and extraction results. The monitoring data was collected during the period from February 26, 2004 through March 31, 2004. Figures, tables and transducer plots are attached at the end of this technical memorandum.

The monitoring system at the McCormick and Baxter site is used to evaluate the functional performance of the containment system and to determine whether the containment system is performing the designed function. As defined in the monitoring plan, the main objectives and goals of this monitoring are as follows:

- Understand changes in groundwater flow outside and inside the barrier containment system;
- Understand changes in gradients/fluxes from the bluff to the river on the north and south sides of the containment system;
- Understand groundwater flow and contaminant movement along the riverfront downgradient of the containment system;

- Determine the effects of groundwater flow toward Willamette Cove in relation to existing NAPL seeps; and

- Determine the effects of river stage and tidal influence on groundwater levels and flow.

2.0 Water-Level Monitoring

Automated Water-Level Data Collection

Groundwater level data is currently being collected at the site from select monitoring wells using automated pressure transducers and manually operated electronic water-level indicators.

Approximately 45 new monitoring wells and 27 existing monitoring wells were monitored during the reporting period to determine groundwater elevations and calculate gradients inside and outside the barrier wall. Twenty-four select monitoring wells are equipped with pressure transducers to collect water-level measurements at hourly intervals (Table 1). The pressure transducers are equipped with internal batteries to allow for in-situ placement in the well. Data is currently downloaded at monthly intervals for each transducer location using a hand-held personal digital assistant or PDA. Groundwater level data was collected manually from the remainder of the monitoring wells bi-weekly during the reporting period.

The monitoring wells designated with an *s* (e.g., MW-36s) are wells screened in the shallow zone. Those wells designated with an *i* (e.g., MW-36i) are screened in the intermediate zone, and those wells designated with a *d* (e.g., MW-36d) are screened in the deep zone. All deep zone monitoring wells were screened beneath the total barrier wall depth in that location. Figure 1 shows the locations of the monitoring well network.

River stage data is recorded daily from the Morrison Bridge and corrected to river stage adjacent to the McCormick and Baxter site. E & E working with the National Oceanic and Atmospheric Administration and the Lower Willamette Group to locate a pressure transducer and radio transmitter in front of the site to monitor river stage in conjunction with monitoring well data collection. Potential locations for the transducer include using a remnant dock dolphin or using the BNRR bridge pier.

2.1 Groundwater Flow and Gradients

Water levels recorded inside the wall were higher relative to water levels outside the barrier wall in well clusters along the riverfront. Figure 2 presents a groundwater contour map for February 16 and 17, 2004. Groundwater inside the wall continues to flow toward the FWDA. Calculated horizontal gradients are 0.004 ft/ft from MW-50s to MW-36s. The upland portion of the site shows groundwater mounding behind the barrier wall with locally reversed gradients toward the bluff. Groundwater outside the wall is diverted around the upland portion of the wall toward Willamette Cove and toward the southeastern portion of the site. In the FWDA, heads inside the wall were approximately

4 to 5 feet higher than heads outside the wall. In the TFA, heads inside the wall were approximately 7 to 8 feet higher than heads outside the wall.

Figure 3 presents a groundwater contour map for March 29 and 30, 2004. Groundwater inside the wall continues to flow toward the FWDA with a more pronounced flattening of the water table in that area. Groundwater continues to be diverted around the upland portion of the wall toward Willamette Cove and toward the southeastern portion of the site. This is consistent with flows patterns from the previous month. Shallow groundwater elevations in wells located on the inside of the barrier wall did not increase significantly this month, which is a change from the previous two reporting periods where an increase was observed. The head difference between the inside of the wall and the outside the wall did not increase significantly during this reporting period.

Vertical groundwater gradients were calculated using data from March 29 and March 30, 2004 for several of the nested wells installed inside and outside the barrier wall. Table 2 presents the calculated vertical gradients between the shallow, intermediate and deep aquifer zones during both rising and ebb tides. Vertical gradients are generally down inside and outside of the wall in the both the FWDA (wells 36, 37, 40, 41) and the TFA (44 and 45). The effect of rising versus ebb tide is not immediately apparent and the effect of lag time is being further evaluated.

2.2 Transducer Plots

Transducer plots were developed for select monitoring wells (See figure 1) inside and outside the barrier wall during the reporting period and are included as an attachment following the tables. The shallow aquifer plots compare monthly water level elevations inside the barrier wall versus water level elevations outside the barrier wall, river elevation, and precipitation data. The intermediate and deep aquifer plots compare monthly water elevations inside the barrier wall versus water level elevations outside the barrier wall and river elevation data. Water levels outside the wall correlate well with river stage along the riverfront portion of the barrier wall. Water levels in shallow aquifer wells inside the wall showed a decrease in elevation in wells located in the FWDA and water levels appeared to level off in wells located in the TFA during the reporting period. Precipitation decreased during the reporting period. Water levels in the TFA previously indicated that groundwater mounding is occurring inside the wall, during this reporting period however we see water elevations leveling off and a slight decrease occurring. This may be due to the decrease in precipitation.

3.0 NAPL Thickness and Extraction

Light non-aqueous phase liquid (LNAPL) and dense non-aqueous liquid (DNAPL) measurements were recorded at several site wells during the reporting period. Monitoring wells in the TFA and the FWDA are normally measured for NAPL thickness twice monthly. When LNAPL exceeding 0.5 ft thickness is encountered during routine monitoring, it is manually extracted using passive skimmers or bailers. When DNAPL exceeding 1.0 ft thickness is encountered during monitoring it is extracted using pneumatic pumps. E & E is continuing to evaluate methods for extracting DNAPL of lesser thickness, but historically, this has been problematic. Tables 3 presents LNAPL and DNAPL thickness measured during March 2004 and the amounts of NAPL extracted at each well following the measurement. Clean wells (not containing NAPL) are gauged weekly for water levels and total depths, and to verify that NAPL has not infiltrated these wells. Figures 4 and 5 show the monitoring well locations of the wells that exhibited LNAPL and/or DNAPL during February and March respectively.

LNAPL

The measured LNAPL thickness ranged from 0.01 foot in MW-32i, MW-Ds, and MW-Gs to 10.09 feet in EW-15s. Eight wells in the FWDA, four wells in the TFA, and one well located in the northern portion of the site exhibited LNAPL during this reporting period (Table 3). This is an increase in distribution from the previous reporting period (from 9 wells exhibiting LNAPL to 13 wells exhibiting LNAPL).

LNAPL thickness measured in March 2004 was overall consistent with the thickness measured in February 2004, with few increases. The largest increase occurred in EW-15s increasing from 5.02 in thickness to 10.09 in thickness, but the quantity extracted remained comparable to the previous reporting period.

DNAPL

Measurable DNAPL was recorded in ten wells during the reporting period. The measured DNAPL thickness ranged from 0.19 feet in EW-15s to 9.09 feet in EW-15s.

Seven wells in the FWDA and three wells in the TFA contained DNAPL during this reporting period (Table 3). This is an increase in distribution from the previous reporting period (from 8 wells exhibiting DNAPL to 10 wells exhibiting DNAPL).

No significant difference in DNAPL thickness measurements was observed from February 2004 to March 2004.

The re-appearance of DNAPL may be attributable to the barrier wall construction activities, which involved operation of heavy equipment and subsurface vibrations along the barrier wall to a depth of 80 feet. The resultant ground pressures and vibrations may have increased the ability of DNAPL to permeate site soils and enter nearby wells. During "normal" site conditions, the high dynamic viscosity of DNAPL, combined with molecular attraction of the DNAPL fluid to soil particles, likely creates substantial resistance to the flow of DNAPL into wells. E & E will continue to carefully monitor the DNAPL levels in site wells to determine whether the recent DNAPL mobilization will continue, or whether the DNAPL thickness in the wells will gradually diminish.

NAPL Extraction

A total of 23 gallons of LNAPL was manually extracted during the reporting period using disposable bailers. This is a slight increase from the previous reporting period.

Table 3 lists the NAPL thickness recorded at the site and the amount of NAPL extracted during the reporting period.

3.2 Seep Visual Inspection and Monitoring

Visual inspections of seep areas were conducted bi-weekly during the reporting period, including the existing seep areas in Willamette Cove and along the shoreline in front of the FWDA and TFA. During the bi-weekly visual inspections, the entire riverfront was checked for the presence of new seep areas, sheen observed on the surface water, and any other observations. No additional seep areas or sheen was observed in Willamette Cove or along the riverfront portion of the site. In November 2003, the seep areas became submerged and have continued to be submerged through this reporting period, subsequently, no sheen or other visual evidence has been observed.

4.0 Summary Observations

Water levels were comparable to the previous reporting period both inside and outside of the barrier wall. Precipitation decreased from the previous reporting period and may be influencing water elevations on the inside of the wall. Water level contours define an area of mounding and deflection on the "backside" of the wall with shallow groundwater flowing around the sides of the wall. This suggests the wall is tight with no evidence of leakage.

Intermediate and deep aquifer wells located on both the inside and outside of the barrier wall along the riverfront continue to mimic the water levels in the Willamette River. Shallow aquifer wells located on the outside of the barrier wall along the riverfront also mimic the water levels in the Willamette River. Water levels in the shallow aquifer wells located on the inside of the wall were observed to be higher in elevation than those on the outside (from 1.5' to a 8.0' difference) but remained consistent from February to March, with an average increase of 0.2 feet, and do not tend to rise and fall with the tides. This also indicates isolation of groundwater inside the wall.

Shallow water levels on the inside of the wall located in the TFA are typically higher than shallow water levels on the inside of the wall located in the FWDA. Flow is generally from the TFA to the FWDA.

Water levels will continue to be monitored and reported on a monthly basis. Shallow aquifer wells MW-36s, MW-37s, MW-44s and MW-45s will no longer be monitored on a weekly basis, as they have leveled off and do not appear to continue to rise. If water levels do begin to show a period of steady increase, E & E will monitor those wells accordingly. E & E and DEQ are considering options for ensuring the water does not overtop the wall from the inside. These options currently include maintaining the wall height at its current elevation of approximately 19 to 19.5 ft NGVD as opposed to cutting it to the ordinary high water level (approx 16.6 ft NGVD) as previously designed, and potentially digging a gravel-filled drainage trench from the TFA toward the FWDA in order to facilitate groundwater flow. Groundwater modeling is being revisited for its potential to serve as a predictive tool.

NAPL monitoring and extraction will continue on a bi-weekly basis, and patterns of NAPL appearance and rebound will be noted and used to optimize removal activities. Observed NAPL during the reporting period was fairly consistent with previous monitoring.

Table 1
Performance Monitoring Well Network
McCormick and Baxter Creosoting Company Site
Portland, Oregon

Well Identification	Monitoring Frequency	Measurement Method	Screen Interval (feet BGS)
Existing Wells			
MW-As	Bi-Monthly	Manual/Water level indicator	22 to 27
MW-32i	Bi-Monthly	Manual/Water level indicator	48.3 to 58.3
MW-Ks	Bi-Monthly	Manual/Water level indicator	13.5 to 33.5
MW-33s	Bi-Monthly	Manual/Water level indicator	19.37 to 29.37
MW-Js	Bi-Monthly	Manual/Water level indicator	13 to 33
MW-14s	Bi-Monthly	Manual/Water level indicator	18.34 to 38.34
MW-Cs	Bi-Monthly	Manual/Water level indicator	19 to 24
MW-15s	Bi-Monthly	Manual/Water level indicator	10.97 to 30.97
MW-18s	Bi-Monthly	Manual/Water level indicator	23.95 to 43.95
EW-22s	Bi-Monthly	Manual/Water level indicator	20 to 40
MW-17s	Bi-Monthly	Manual/Water level indicator	14.85 to 34.85
EW-23s	Bi-Monthly	Manual/Water level indicator	18 to 38
MW-34i	Bi-Monthly	Manual/Water level indicator	55.2 to 75.2
MW-31s	Bi-Monthly	Manual/Water level indicator	9.42 to 19.42
MW-Os	Bi-Monthly	Manual/Water level indicator	13 to 35
MW-5s	Bi-Monthly	Manual/Water level indicator	9.34 to 29.34
MW-2s	Bi-Monthly	Manual/Water level indicator	13.15 to 33.15
MW-3s	Bi-Monthly	Manual/Water level indicator	10.03 to 30.03
MW-7s	Bi-Monthly	Manual/Water level indicator	16.35 to 36.35
MW-8i	Bi-Monthly	Manual/Water level indicator	16.35 to 36.35
MW-23d	Bi-Monthly	Manual/Water level indicator	171.17 to 181.17
MW-LRs	Bi-Monthly	Manual/Water level indicator	14.8 to 34.8
MW-10s	Bi-Monthly	Manual/Water level indicator	14.60 to 34.60
MW-7-WC	Bi-Monthly	Manual/Water level indicator	25 to 35
MW-36s	Hourly	Pressure Transducer	12-22
MW-36i	Hourly	Pressure Transducer	40-45
MW-36d	Hourly	Pressure Transducer	80-85
MW-37s	Hourly	Pressure Transducer	12-22
MW-37i	Hourly	Pressure Transducer	40-45
MW-37d	Hourly	Pressure Transducer	80-85
MW-38s	Bi-Monthly	Manual/Water level indicator	12-22
MW-38i	Bi-Monthly	Manual/Water level indicator	40-45
MW-38d	Bi-Monthly	Manual/Water level indicator	80-85
MW-39s	Bi-Monthly	Manual/Water level indicator	12-22
MW-39i	Bi-Monthly	Manual/Water level indicator	40-45
MW-39d	Bi-Monthly	Manual/Water level indicator	80-85
MW-40s	Hourly	Pressure Transducer	12-22
MW-40i	Hourly	Pressure Transducer	40-45
MW-40d	Hourly	Pressure Transducer	80-85
MW-41s	Hourly	Pressure Transducer	12-22
MW-41i	Hourly	Pressure Transducer	40-45
MW-41d	Hourly	Pressure Transducer	80-85
MW-42s	Bi-Monthly	Manual/Water level indicator	TBD
MW-42i	Bi-Monthly	Manual/Water level indicator	40-45
MW-42d	Bi-Monthly	Manual/Water level indicator	80-85
MW-43s	Bi-Monthly	Manual/Water level indicator	12-22
MW-43i	Bi-Monthly	Manual/Water level indicator	40-45
MW-43d	Bi-Monthly	Manual/Water level indicator	80-85

Table 1
Performance Monitoring Well Network
McCormick and Baxter Creosoting Company Site
Portland, Oregon

Well Identification	Monitoring Frequency	Measurement Method	Screen Interval (feet BGS)
MW-44s	Hourly	Pressure Transducer	12-22
MW-44i	Hourly	Pressure Transducer	40-45
MW-44d	Hourly	Pressure Transducer	80-85
MW-45s	Hourly	Pressure Transducer	12-22
MW-45i	Hourly	Pressure Transducer	40-45
MW-45d	Hourly	Pressure Transducer	80-85
MW-46s	Bi-Monthly	Manual/Water level indicator	12-22
MW-47s	Bi-Monthly	Manual/Water level indicator	20-35
MW-48s	Bi-Monthly	Manual/Water level indicator	20-35
MW-49s	Bi-Monthly	Manual/Water level indicator	20-35
MW-50s	Hourly	Pressure Transducer	20-35
MW-51s	Hourly	Pressure Transducer	20-35
MW-52s	Bi-Monthly	Manual/Water level indicator	20-35
MW-53s	Bi-Monthly	Manual/Water level indicator	20-35
MW-54s	Hourly	Pressure Transducer	20-35
MW-55s	Hourly	Pressure Transducer	20-35
MW-56s	Bi-Monthly	Manual/Water level indicator	20-35
MW-57s	Bi-Monthly	Manual/Water level indicator	20-35
MW-58s	Hourly	Pressure Transducer	20-35
MW-58i	Bi-Monthly	Manual/Water level indicator	40-45
MW-58d	Hourly	Pressure Transducer	80-85

Table 2
VERTICAL GROUNDWATER ELEVATION GRADIENTS
3/29/2004- 03/30/2004
McCORMICK & BAXTER CREOSOTING COMPANY
PORTLAND, OREGON

Well ID	High Tide (1100) Mid-point value	Direction	Low Tide (2100) Mid-point value	Direction
MW-36s to MW-36d	0.08075	down	0.09318	down
MW-36s to MW-36i	0.1904	down	0.20680	down
MW-36i to MW-36d	0.005251	up	0.004084	down
MW-37s to MW-37d	0.003407	up	0.007905	down
MW-37s to MW-37i	0.003897	up	0.020560	down
MW-37i to MW-37d	0.003122	up	0.005677	down
MW-40s to MW-40d	0.1061	down	0.1184	down
MW-40s to MW-40i	0.2546	down	0.260600	down
MW-40i to MW-40d	0.01112	up	0.006148	down
MW-41s to MW-41d	0.003099	up	0.007921	down
MW-41s to MW-41i	0.0137	down	0.022840	down
MW-41i to MW-41d	0.015	up	0.002648	up
MW-44s to MW-44d	0.135	down	0.129200	down
MW-44s to MW-44i	0.304	down	0.308100	down
MW-44i to MW-44d	0.002551	down	0.011050	down
MW-45s to MW-45d	0.002403	up	0.010130	down
MW-45s to MW-45i	0.01038	down	0.013410	down
MW-45i to MW-45d	0.01081	up	0.007968	down

Note: Gradients calculated using EPA vertical gradient calculator.
http://www.epa.gov/athens/learn2model/part-two/onsite/vgradient02.htm

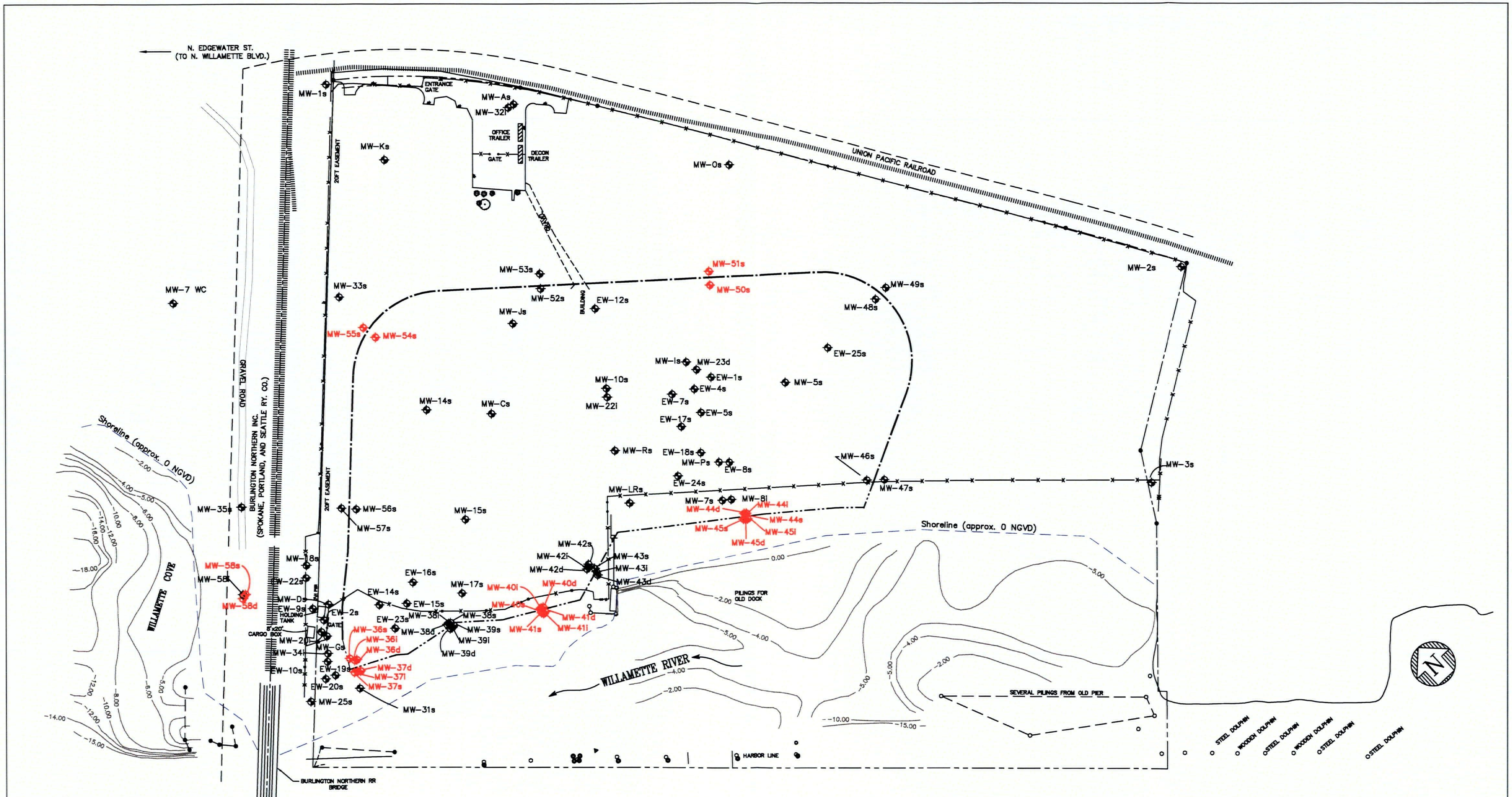
Table 3 LNAPL and DNAPL Measurement and Extraction Summary February 26 through March 31, 2004 McCormcik and Baxter Creosoting Company Site Porltand, Oregon			
Date Measured	**Well Number**	**Thickness (feet)**	**Extracted (Gallons)**
LNAPL			
3/1/2004 8:38	MW-32i	0.01	0
3/8/2004 0:00	EW-10s	0.42	3
3/8/2004 0:00	EW-15s	10.09	10
3/8/2004 0:00	EW-1s	0.04	0
3/8/2004 0:00	EW-23s	1.64	2
3/8/2004 0:00	MW-56s	0.30	0
3/8/2004 0:00	MW-Ds	0.01	0
3/8/2004 0:00	MW-Es	0.14	0
3/8/2004 0:00	MW-Gs	0.01	0
3/22/2004 0:00	EW-10s	1.55	1.3
3/22/2004 0:00	EW-15s	7.85	5.2
3/22/2004 0:00	EW-17s	0.07	0
3/22/2004 0:00	EW-1s	0.02	0
3/22/2004 0:00	EW-23s	1.46	1
3/22/2004 0:00	MW-20i	0.02	0
3/22/2004 0:00	MW-56s	0.32	0
3/22/2004 0:00	MW-Es	0.72	0.5
3/22/2004 0:00	MW-Gs	0.02	0
3/22/2004 0:00	MW-Is	0.02	0
3/22/2004 0:00	MW-Rs	0.07	0
DNAPL			
3/8/2004 0:00	EW-9s	1.99	0
3/8/2004 0:00	EW-15s	9.09	0
3/8/2004 0:00	MW-20i	0.59	0
3/8/2004 0:00	MW-Ds	2.97	0
3/8/2004 0:00	MW-Gs	1.31	0
3/8/2004 0:00	MW-Is	3.82	0
3/8/2004 0:00	EW-1s	3.66	0
3/22/2004 0:00	EW-9s	1.93	0
3/22/2004 0:00	EW-8s	1.97	0
3/22/2004 0:00	MW-Is	4.70	0
3/22/2004 0:00	EW-15s	0.19	0
3/22/2004 0:00	EW-23s	0.34	0
3/22/2004 0:00	MW-20i	7.02	0
3/22/2004 0:00	MW-Ds	3.50	0
3/22/2004 0:00	MW-Es	0.43	0

Table 4

GROUNDWATER ELEVATION GRADIENTS
McCORMICK & BAXTER CREOSOTING COMPANY
PORTLAND, OREGON

TFA Monitoring Wells						
Date	MW-49s Groundwater Elevation (ft, MSL)	MW-47s Groundwater Elevation (ft, MSL)	Horizontal Distance (ft)	Angle of Flowpath Deviation (degrees)	Horizontal Gradient (ft/ft)	Horizontal Gradient (ft/mile)
Feb-04	15.74	6.05	387.5	45	0.035	187
Mar-04	15.20	5.61	387.5	38	0.031	166
FWDA Monitoring Wells						
Date	MW-50s Groundwater Elevation (ft, MSL)	MW-36s Groundwater Elevation (ft, MSL)	Horizontal Distance (ft)	Angle of Flowpath Deviation (degrees)	Horizontal Gradient (ft/ft)	Horizontal Gradient (ft/mile)
Feb-04	14.44	10.53	1,090.40	11	0.004	19
Mar-04	14.53	10.41	1,090.40	11	0.004	20

Key:
ft = Feet.
ft/ft = Feet per foot.
ft/mile = Feet per mile.
FWDA = Former waste disposal area.
MSL = Mean sea level.
TFA = Tank farm area.



LEGEND

◆	WELL LOCATIONS
◆ (red)	WELL LOCATIONS (WITH TRANSDUCER)
IIIIIIIIII	RAILROAD TRACKS
- - - - -	PROPERTY LINE
—·—·—	BARRIER WALL

BRG PLOTTED: 03-05-04

NO.	DATE	DSN	APP'D	DESCRIPTION

REVISIONS

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International Specialists in the Environment
Portland, Oregon

DESIGNED BY: M. OCHSNER

CHECKED BY:

DRAWN BY: E. YAO

APPROVED BY

FIGURE 1

MONITORING WELL LOCATIONS

McCORMICK AND BAXTER CREOSOTING COMPANY

SCALE	DATE ISSUED	C.A.D. FILE NO.	FIGURE NO.
NOTED	03-05-04	MBGW02_1.dwg	1

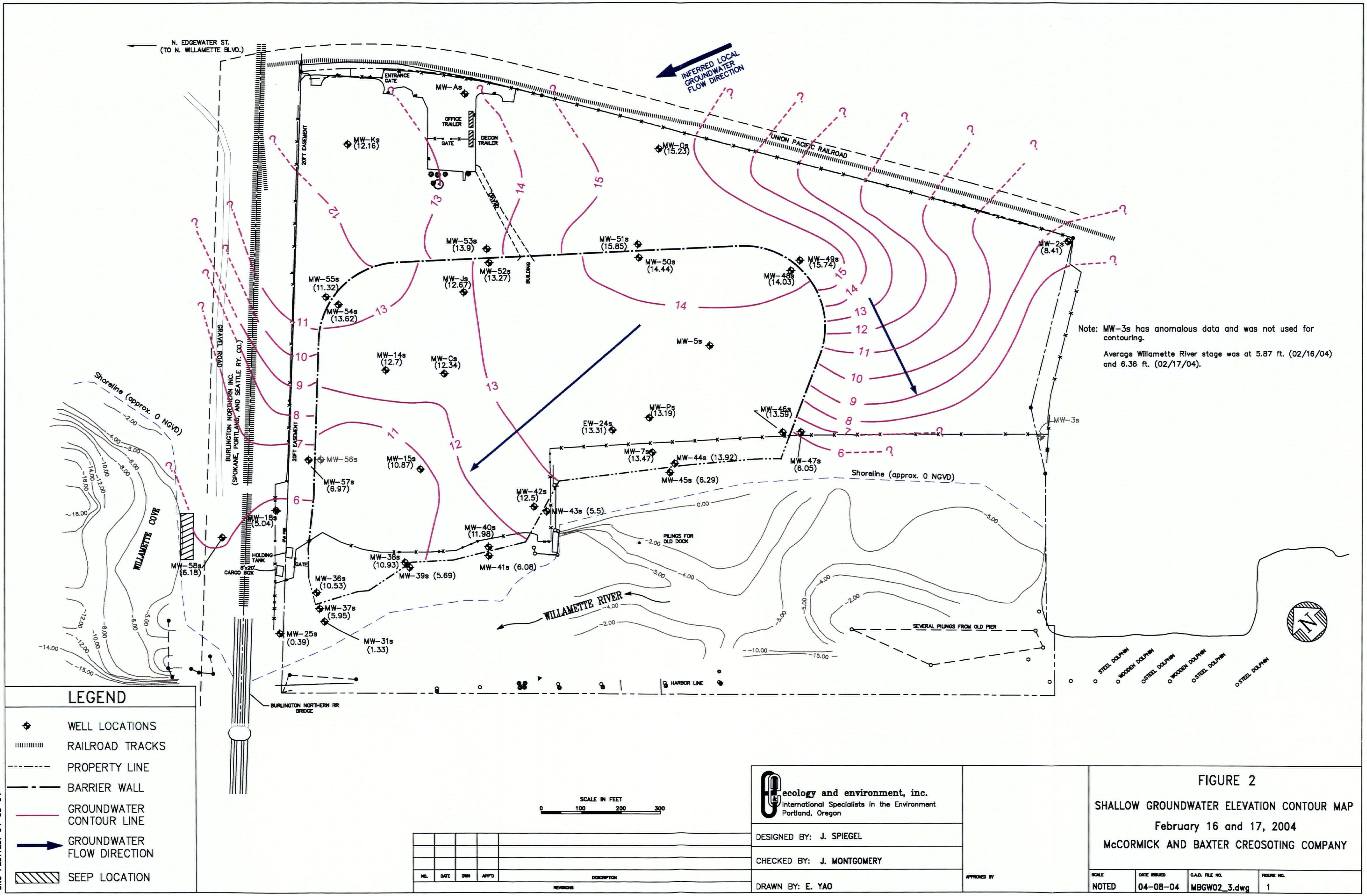
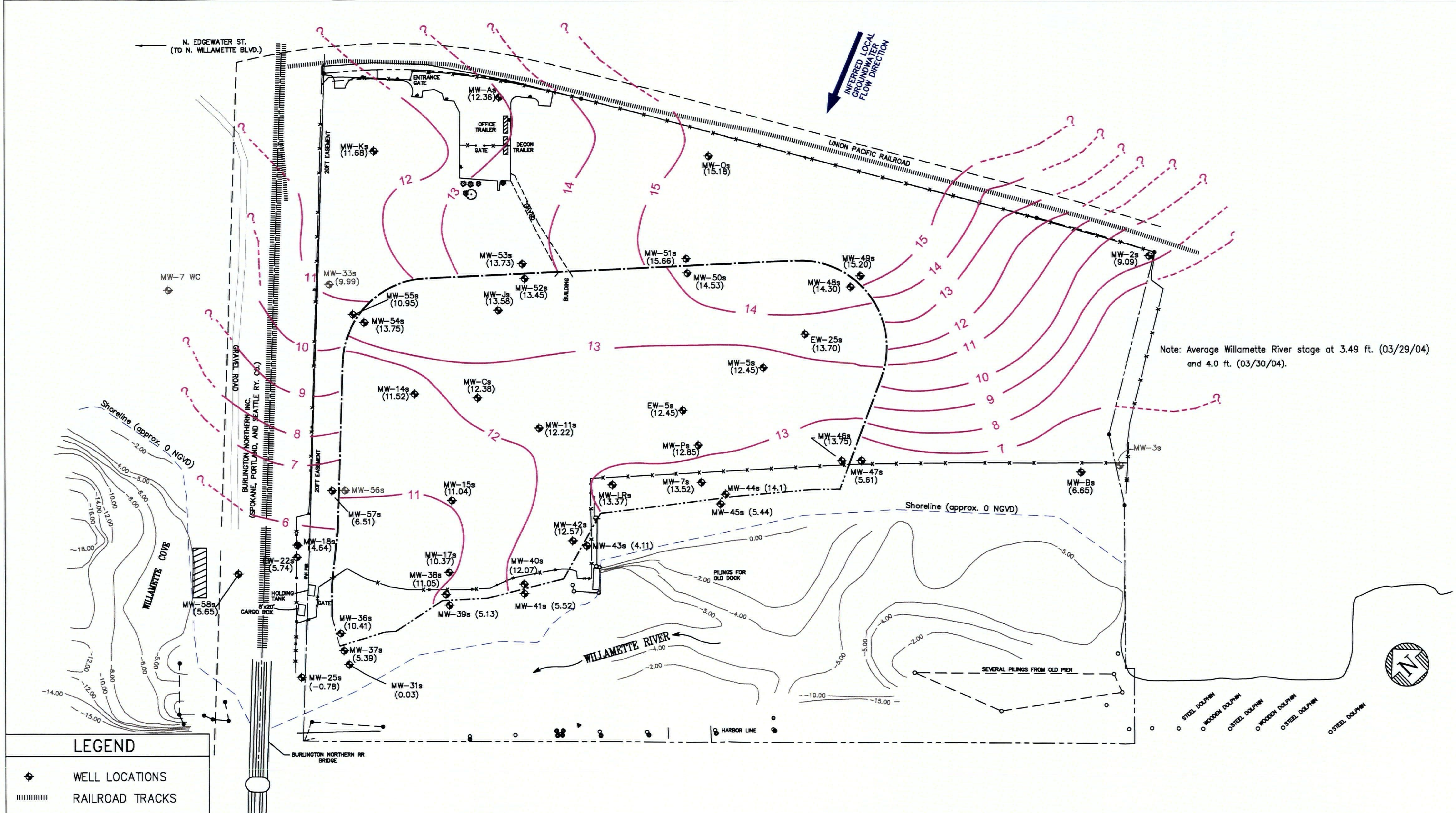


FIGURE 2
SHALLOW GROUNDWATER ELEVATION CONTOUR MAP
February 16 and 17, 2004
McCORMICK AND BAXTER CREOSOTING COMPANY



LEGEND

- WELL LOCATIONS
- RAILROAD TRACKS
- PROPERTY LINE
- BARRIER WALL
- GROUNDWATER CONTOUR LINE
- GROUNDWATER FLOW DIRECTION
- SEEP LOCATION

BRG PLOTTED: 04-08-04

NO.	DATE	DWN	APP'D	DESCRIPTION

REVISIONS

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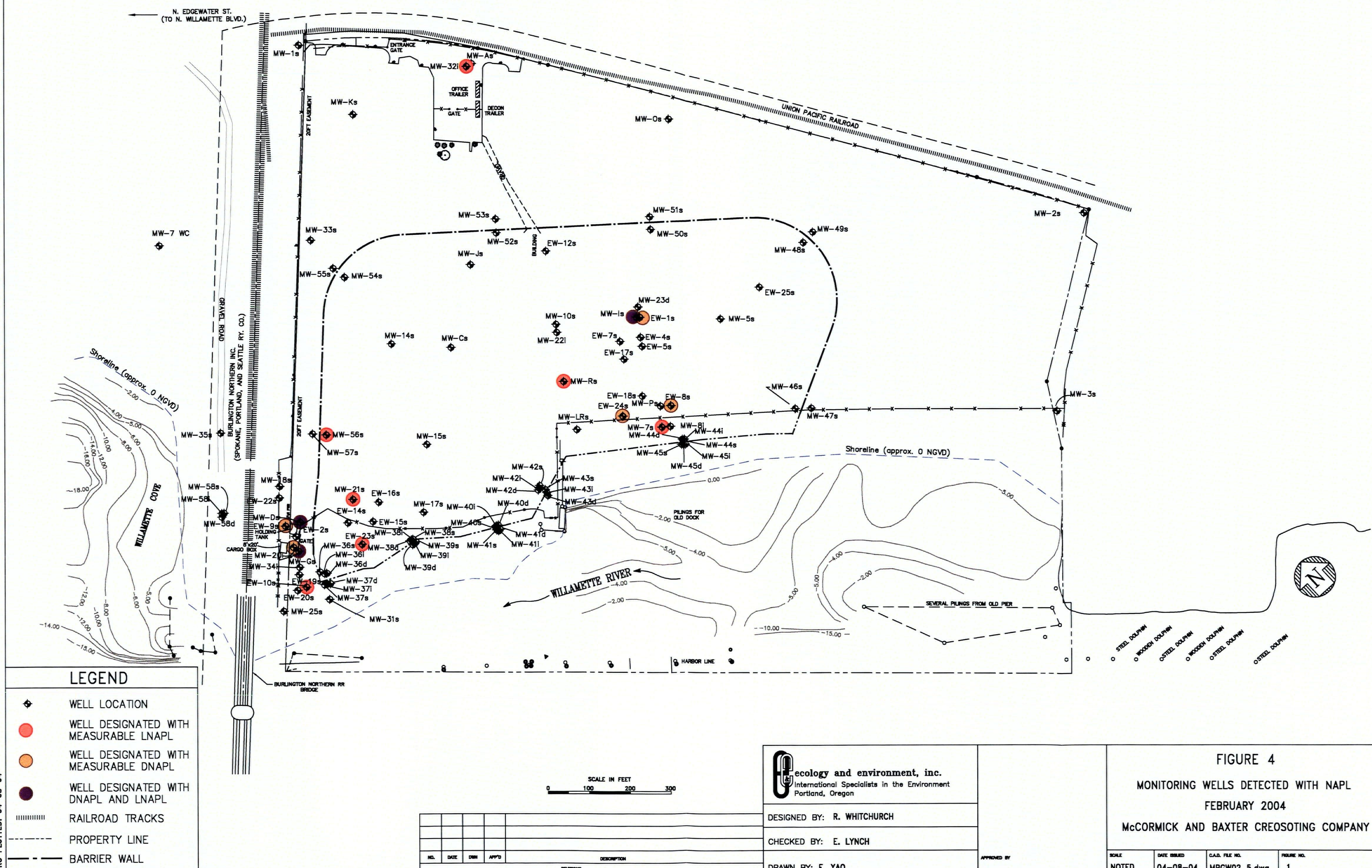
DESIGNED BY: J. SPIEGEL
CHECKED BY: E. LYNCH
DRAWN BY: E. YAO
APPROVED BY

FIGURE 3

SHALLOW GROUNDWATER ELEVATION CONTOUR MAP
MARCH 29 and 30, 2004
McCORMICK AND BAXTER CREOSOTING COMPANY

SCALE	DATE ISSUED	C.A.D. FILE NO.	FIGURE NO.
NOTED	04-08-04	MBGW02_2.dwg	1



BRG PLOTTED: 04-08-04

NO.	DATE	DWN	APP'D	DESCRIPTION
				REVISIONS

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Portland, Oregon

DESIGNED BY: R. WHITCHURCH

CHECKED BY: E. LYNCH

DRAWN BY: E. YAO

APPROVED BY

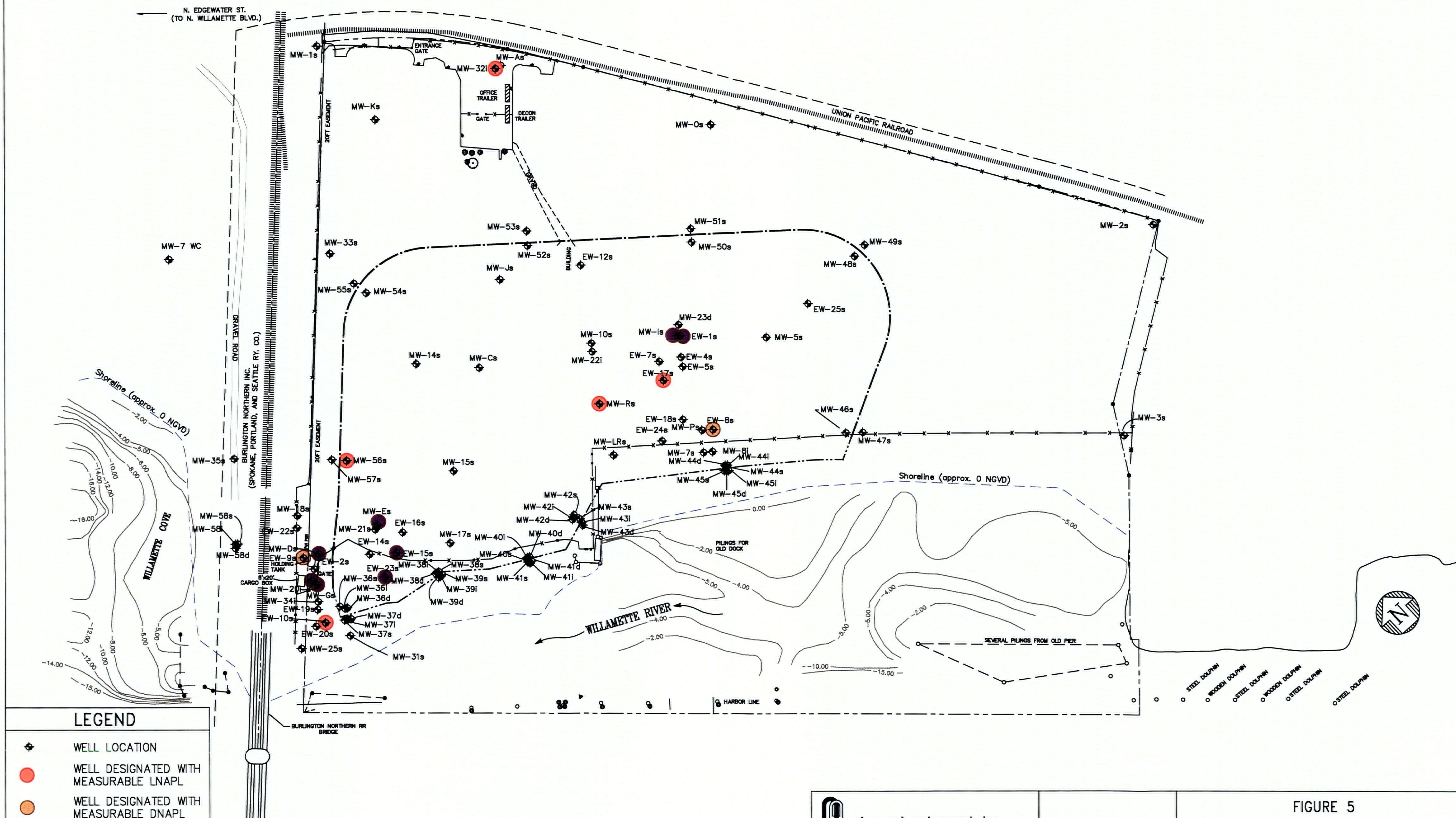
FIGURE 4

MONITORING WELLS DETECTED WITH NAPL

FEBRUARY 2004

McCORMICK AND BAXTER CREOSOTING COMPANY

SCALE	DATE ISSUED	C.A.D. FILE NO.	FIGURE NO.
NOTED	04-08-04	MBGW02_5.dwg	1



LEGEND

- WELL LOCATION
- WELL DESIGNATED WITH MEASURABLE LNAPL
- WELL DESIGNATED WITH MEASURABLE DNAPL
- WELL DESIGNATED WITH DNAPL AND LNAPL
- RAILROAD TRACKS
- PROPERTY LINE
- BARRIER WALL

NO.	DATE	DWN	APP'D	DESCRIPTION

REVISIONS

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Portland, Oregon

DESIGNED BY: R. WHITCHURCH

CHECKED BY: E. LYNCH

DRAWN BY: E. YAO

APPROVED BY

FIGURE 5

MONITORING WELLS DETECTED WITH NAPL
MARCH 2004
McCORMICK AND BAXTER CREOSOTING COMPANY

SCALE	DATE ISSUED	C.A.D. FILE NO.	FIGURE NO.
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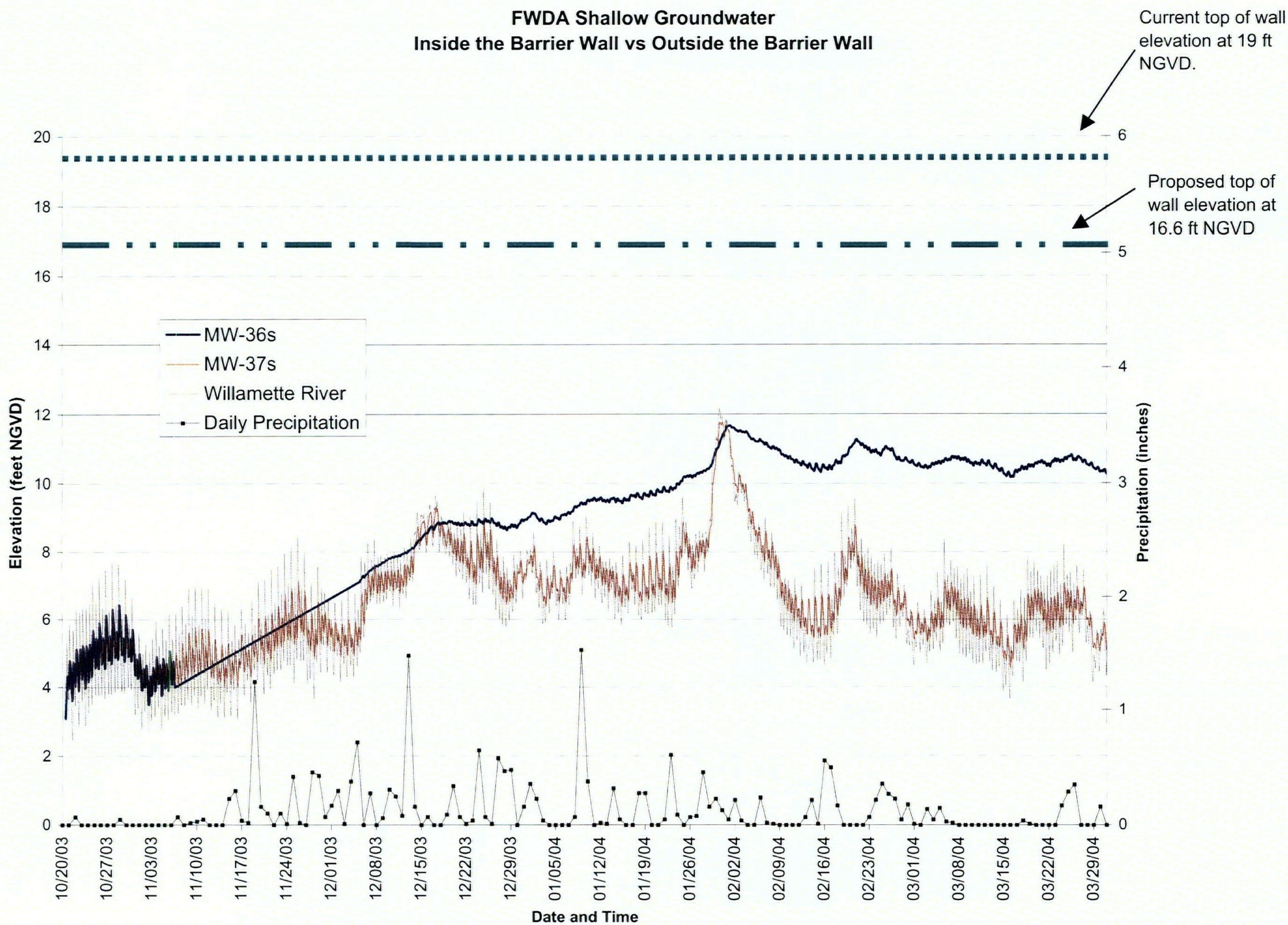
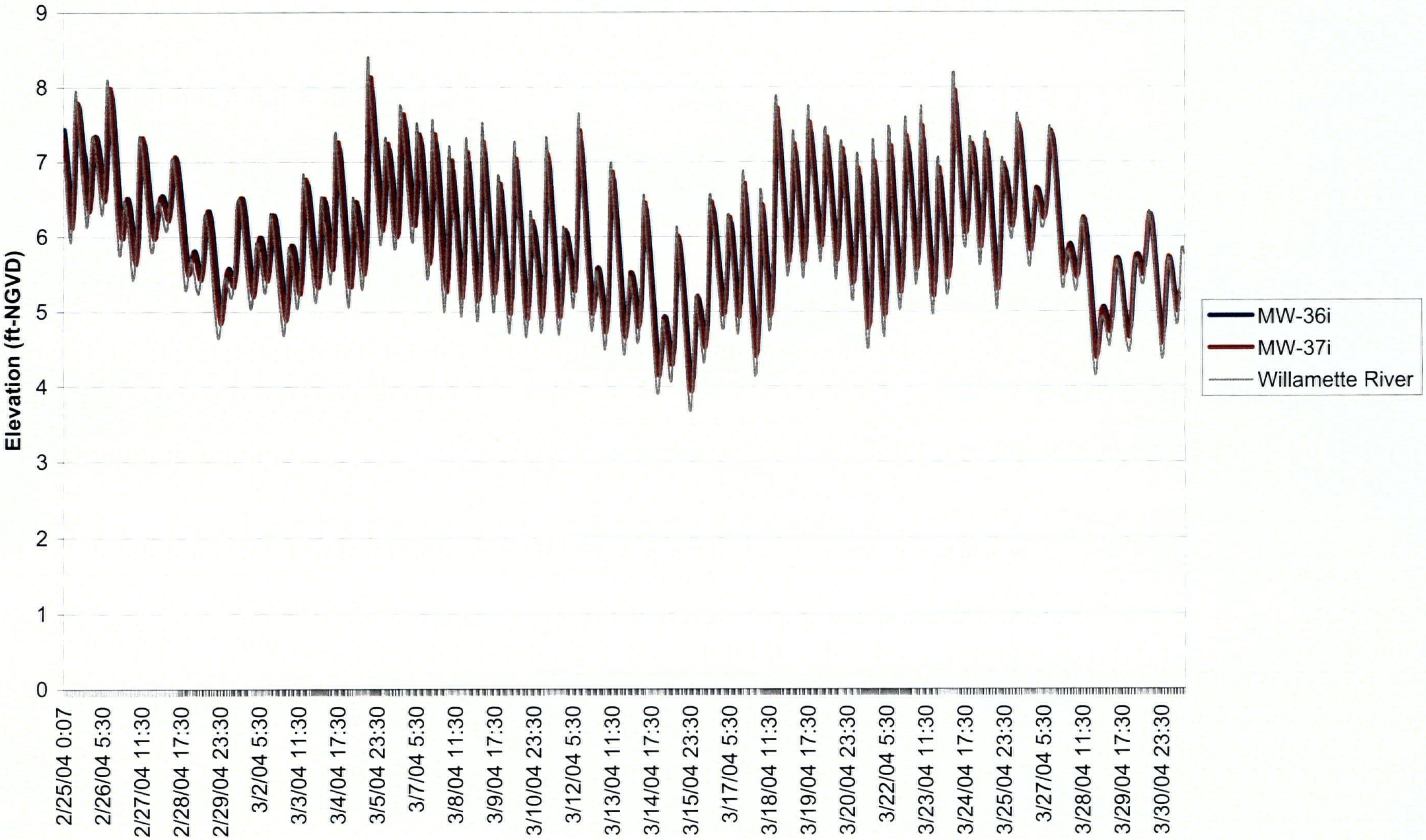
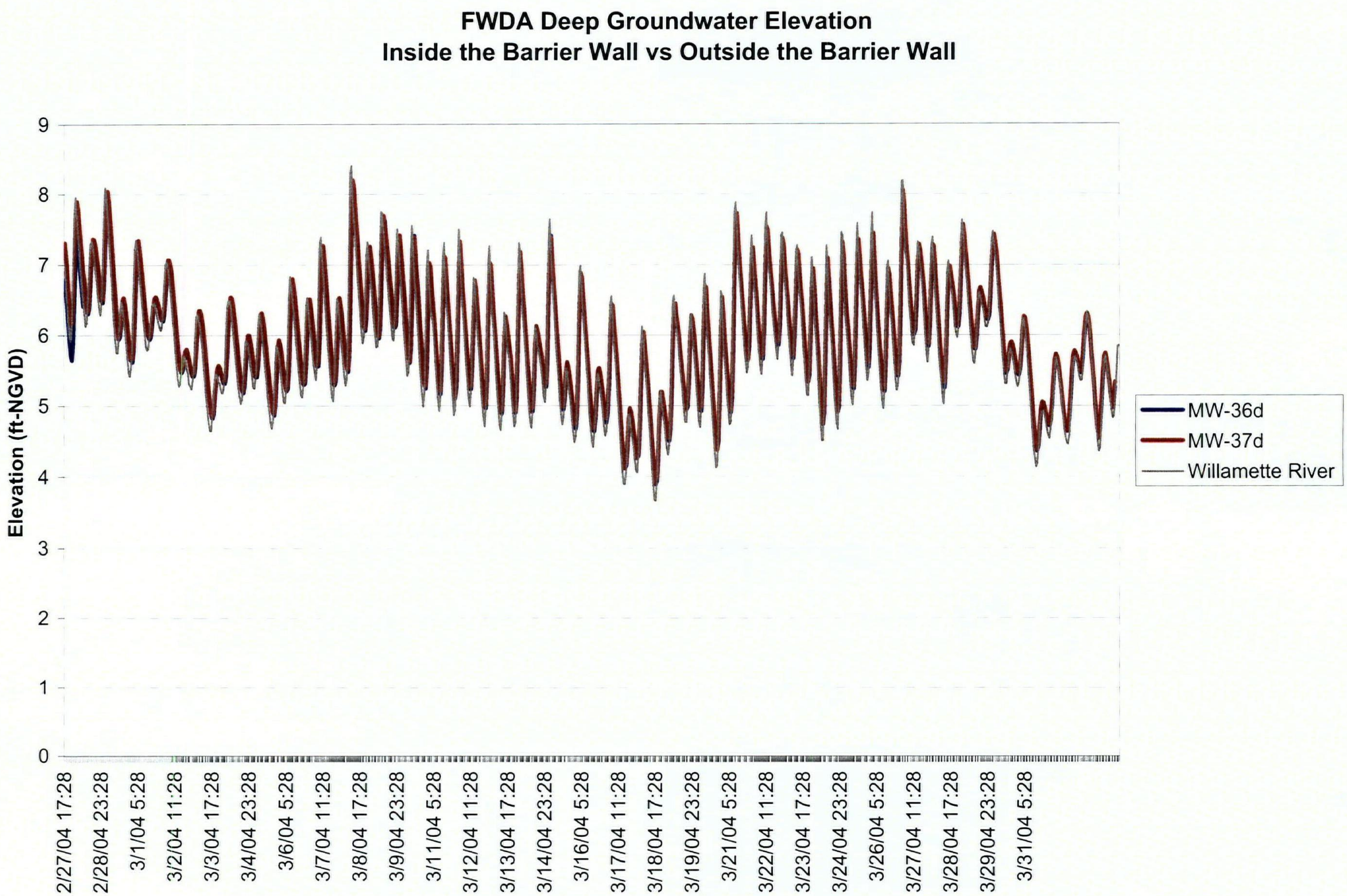
BRG PLOTTED: 04-08-04

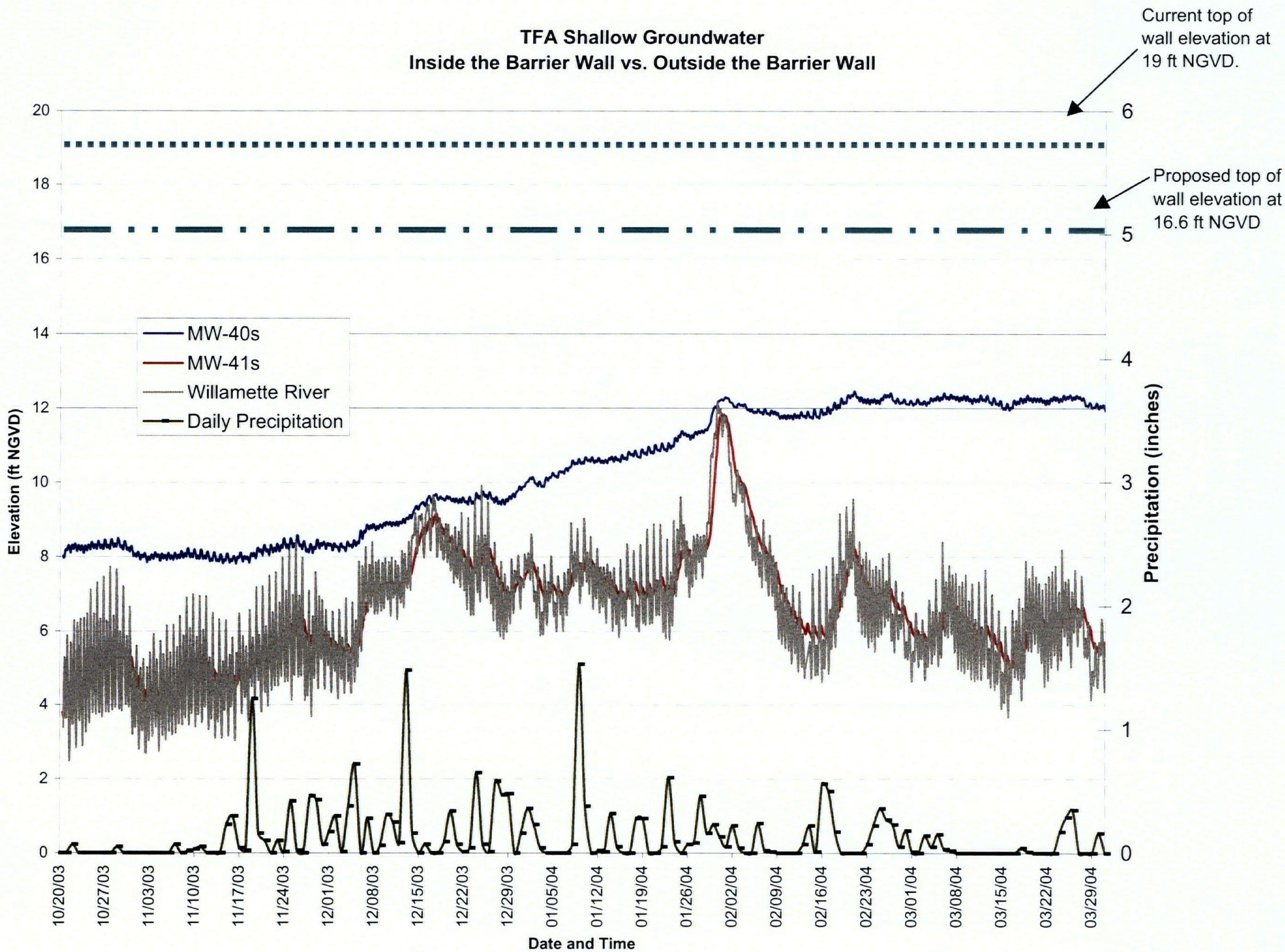


*Note: Precipitation data presented in this graph is obtained from the City of Portland HYDRA Rainfall NEtwork, Swan Island raingage at http://oregon.usgs.gov/non-usgs/bes/

FWDA Intermediate Groundwater Elevation
Inside the Barrier Wall vs Outside the Barrier Wall

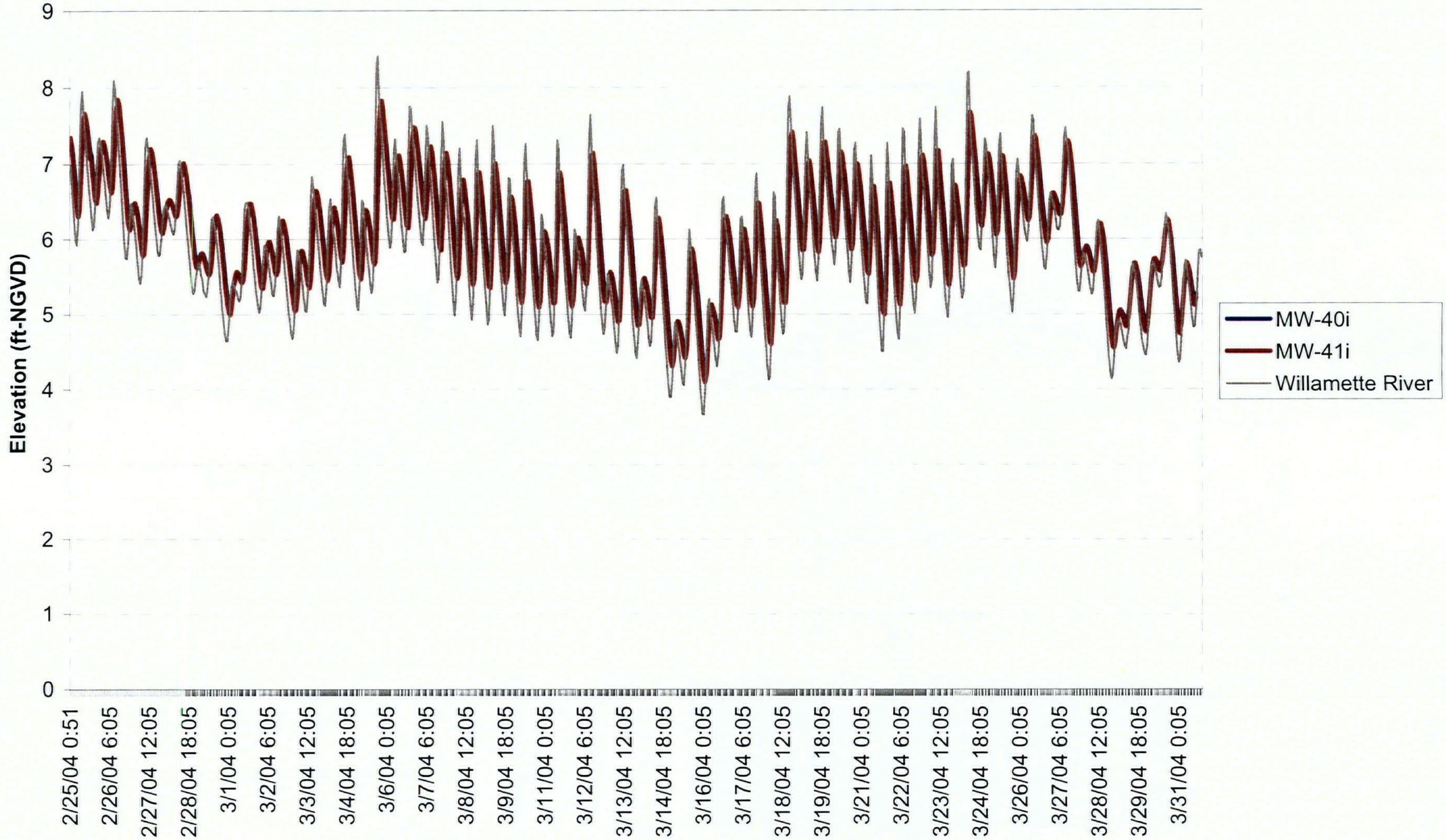


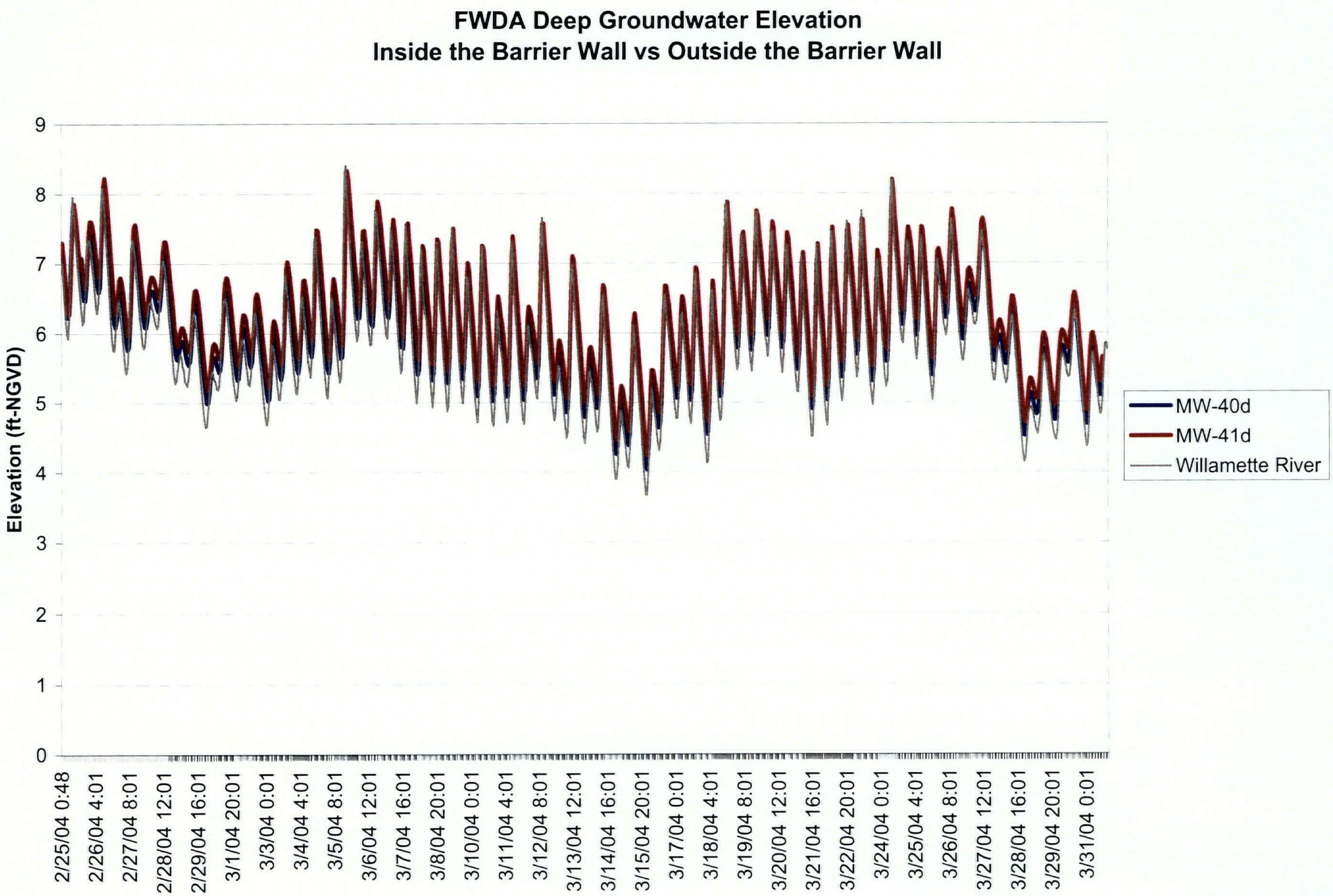

FWDA Deep Groundwater Elevation
Inside the Barrier Wall vs Outside the Barrier Wall
Elevation (ft-NGVD)
9
8
7
6
5
4
3
2
1
0
2/27/04 17:28
2/28/04 23:28
3/1/04 5:28
3/2/04 11:28
3/3/04 17:28
3/4/04 23:28
3/6/04 5:28
3/7/04 11:28
3/8/04 17:28
3/9/04 23:28
3/11/04 5:28
3/12/04 11:28
3/13/04 17:28
3/14/04 23:28
3/16/04 5:28
3/17/04 11:28
3/18/04 17:28
3/19/04 23:28
3/21/04 5:28
3/22/04 11:28
3/23/04 17:28
3/24/04 23:28
3/26/04 5:28
3/27/04 11:28
3/28/04 17:28
3/29/04 23:28
3/31/04 5:28
MW-36d
MW-37d
Willamette River

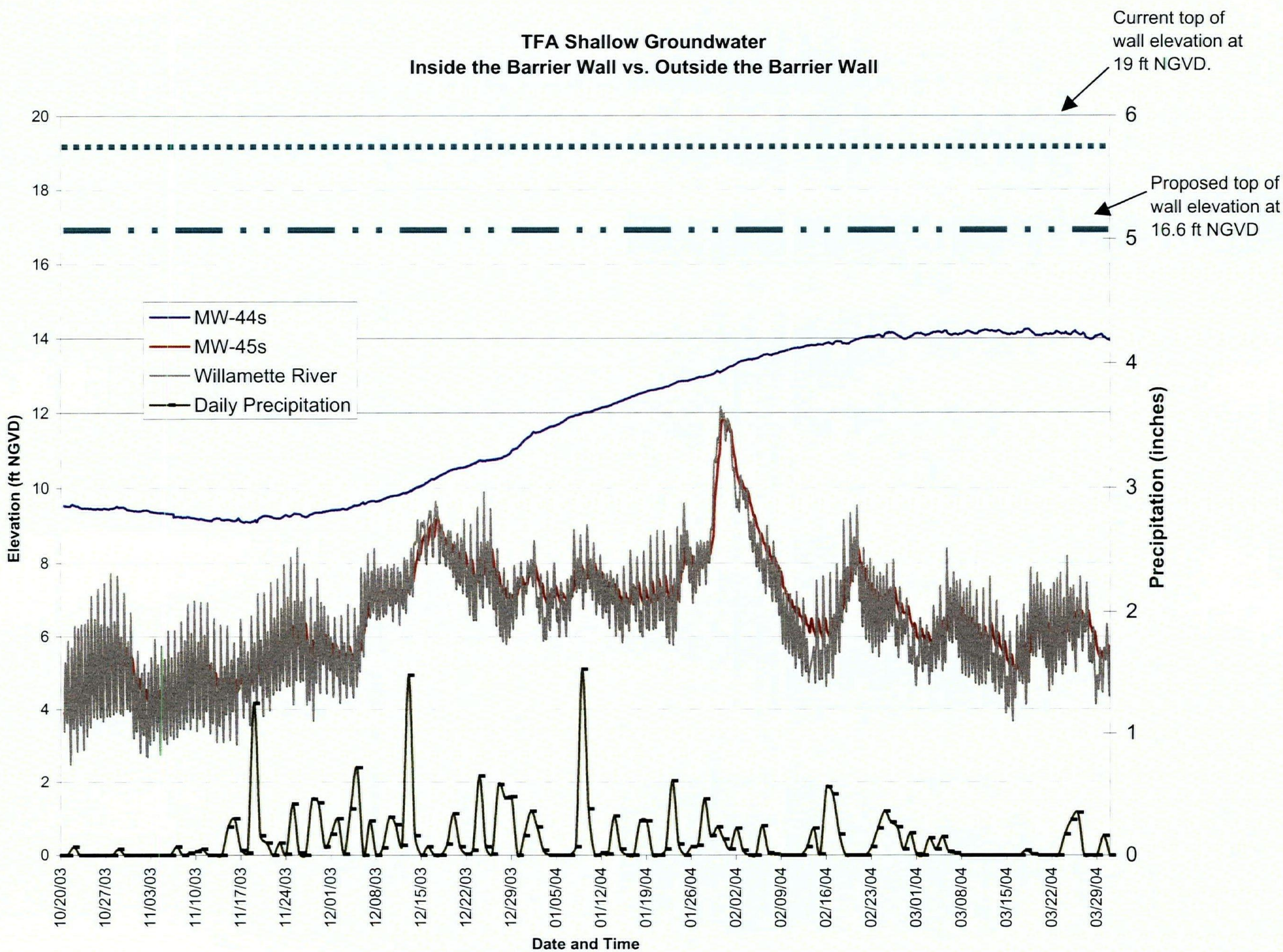


*Note: Precipitation data presented in this graph is obtained from the City of Portland HYDRA Rainfall Network, Swan Island raingage, at http://oregon.usgs.gov/non-usgs/bes/

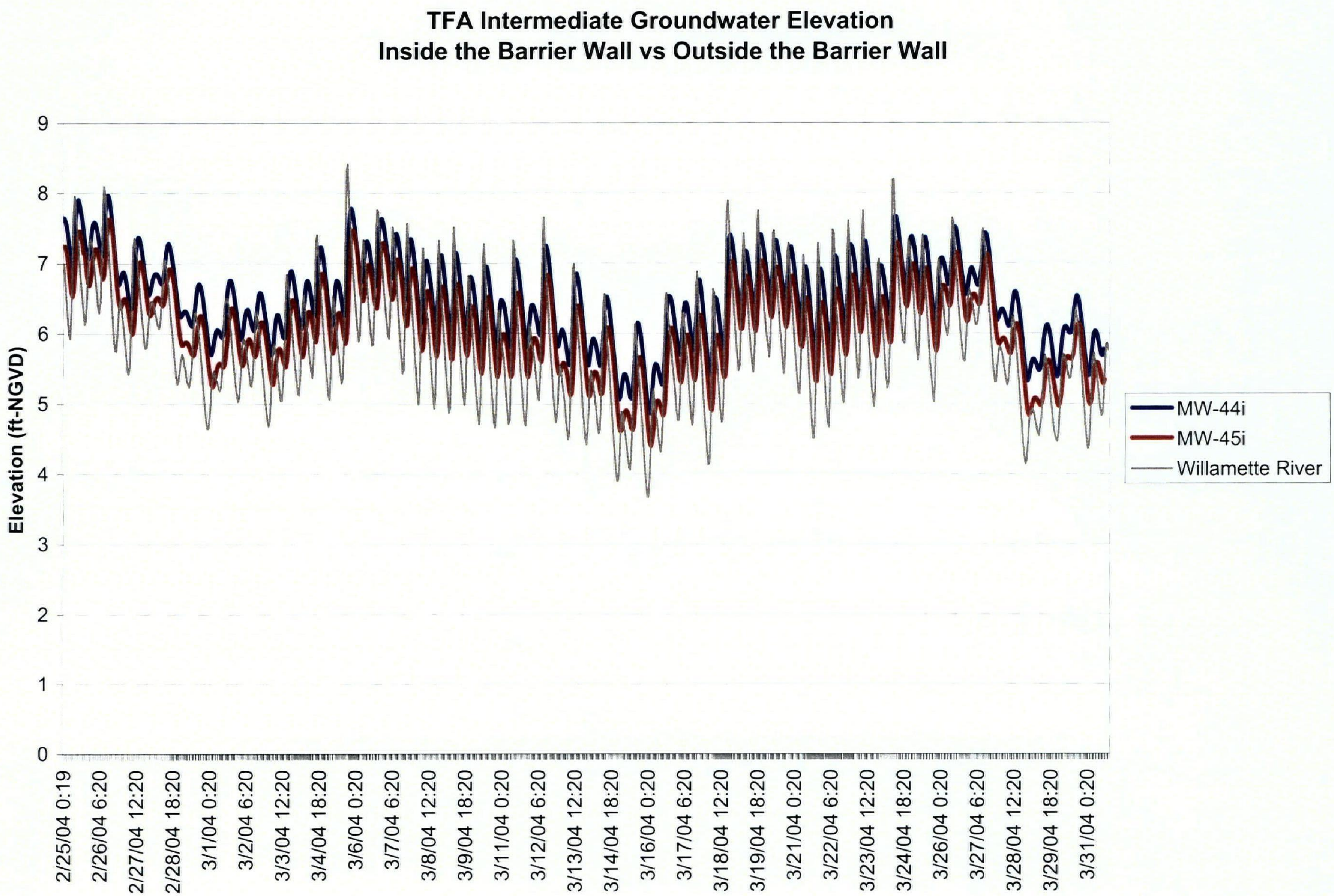
FWDA Intermediate Groundwater Elevation
Inside the Barrier Wall vs Outside the Barrier Wall




FWDA Deep Groundwater Elevation
Inside the Barrier Wall vs Outside the Barrier Wall
Elevation (ft-NGVD)
9
8
7
6
5
4
3
2
1
0
MW-40d
MW-41d
Willamette River
2/25/04 0:48
2/26/04 4:01
2/27/04 8:01
2/28/04 12:01
2/29/04 16:01
3/1/04 20:01
3/3/04 0:01
3/4/04 4:01
3/5/04 8:01
3/6/04 12:01
3/7/04 16:01
3/8/04 20:01
3/10/04 0:01
3/11/04 4:01
3/12/04 8:01
3/13/04 12:01
3/14/04 16:01
3/15/04 20:01
3/17/04 0:01
3/18/04 4:01
3/19/04 8:01
3/20/04 12:01
3/21/04 16:01
3/22/04 20:01
3/24/04 0:01
3/25/04 4:01
3/26/04 8:01
3/27/04 12:01
3/28/04 16:01
3/29/04 20:01
3/31/04 0:01

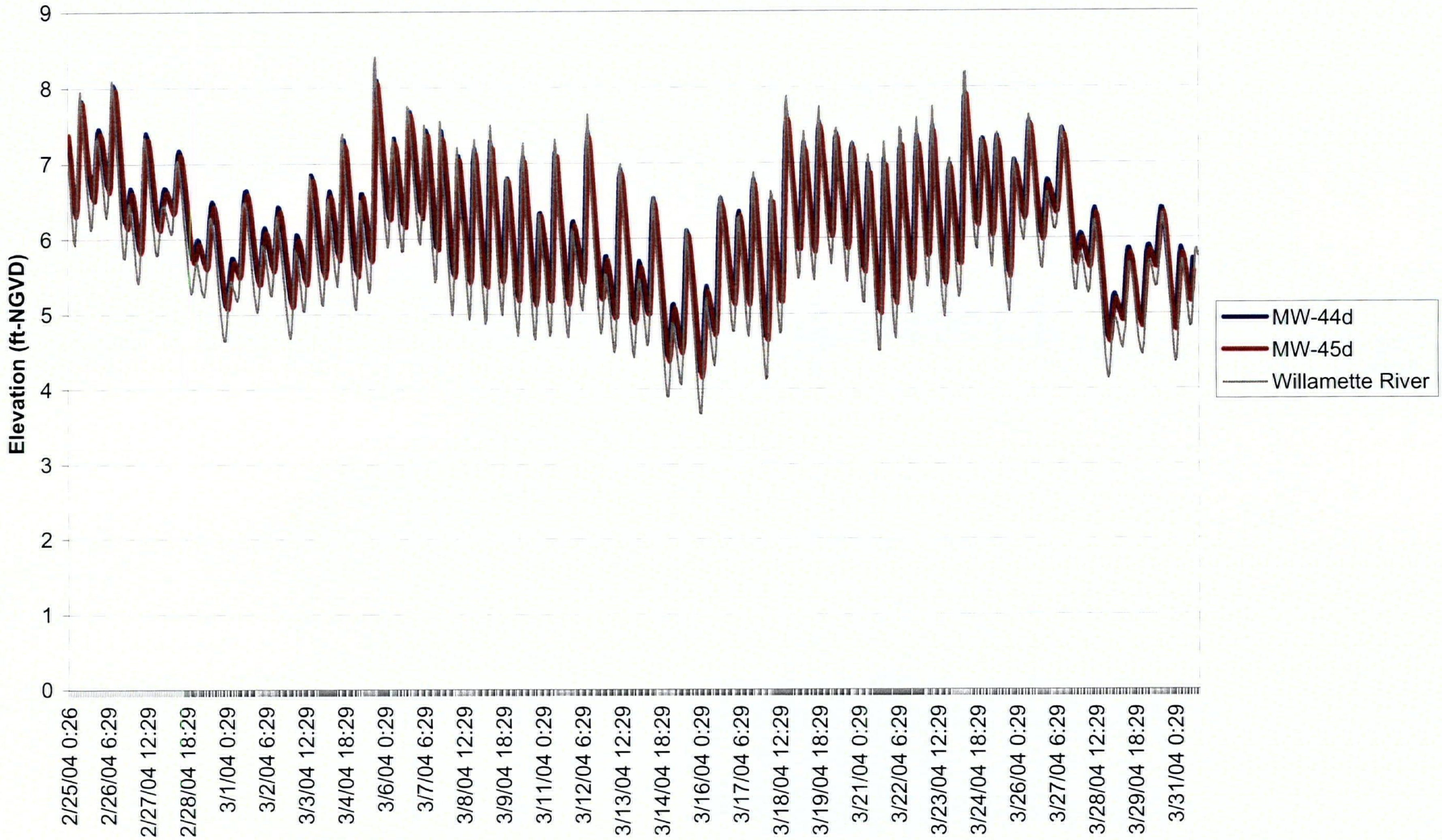


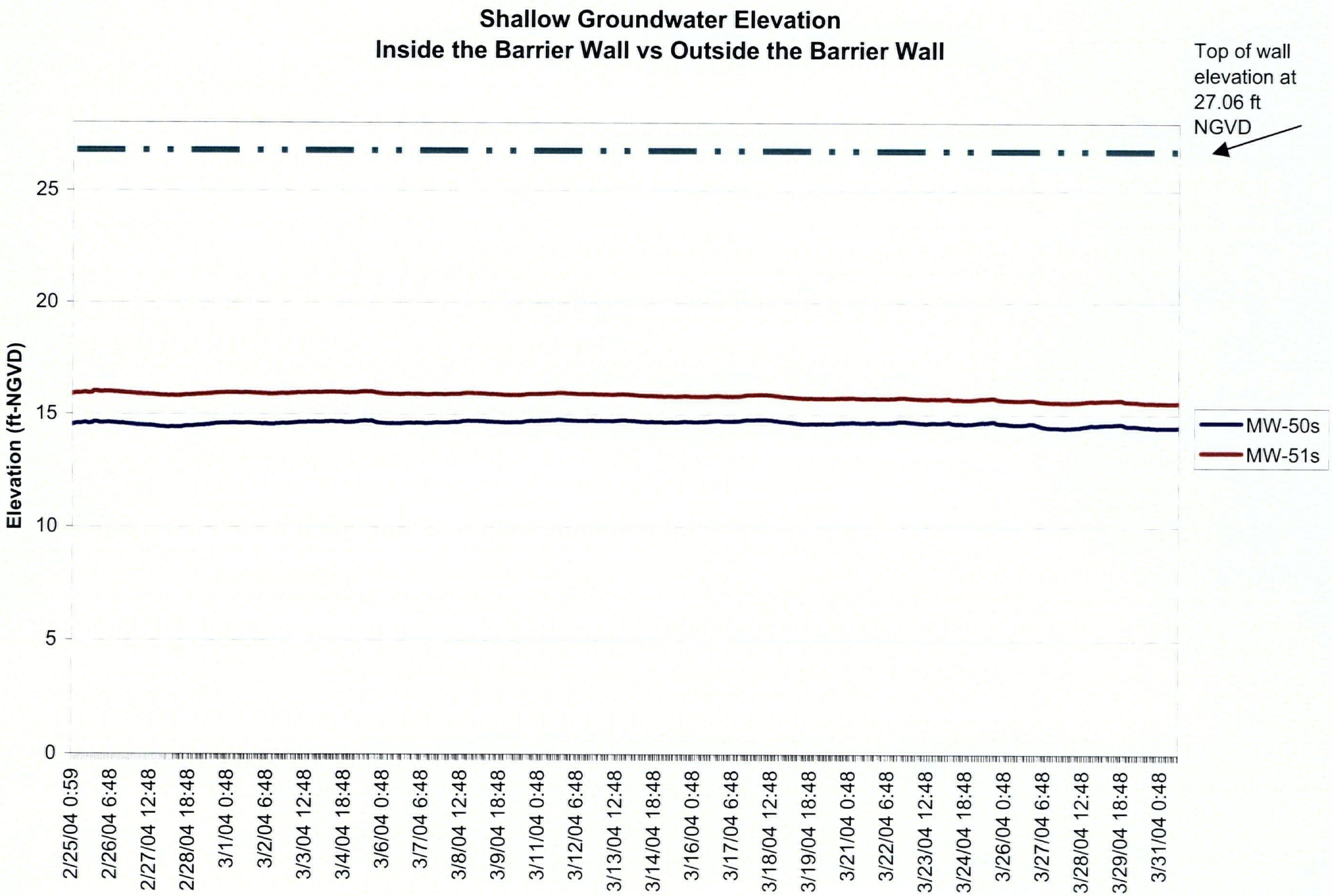
*Note: Precipitation data presented in this graph is obtained from the City of Portland HYDRA Rainfall Network, Swan Island raingage at http://oregon.usgs.gov/non-usgs/bes/



TFA Intermediate Groundwater Elevation
Inside the Barrier Wall vs Outside the Barrier Wall
Elevation (ft-NGVD)
0
1
2
3
4
5
6
7
8
9
MW-44i
MW-45i
Willamette River
2/25/04 0:19
2/26/04 6:20
2/27/04 12:20
2/28/04 18:20
3/1/04 0:20
3/2/04 6:20
3/3/04 12:20
3/4/04 18:20
3/6/04 0:20
3/7/04 6:20
3/8/04 12:20
3/9/04 18:20
3/11/04 0:20
3/12/04 6:20
3/13/04 12:20
3/14/04 18:20
3/16/04 0:20
3/17/04 6:20
3/18/04 12:20
3/19/04 18:20
3/21/04 0:20
3/22/04 6:20
3/23/04 12:20
3/24/04 18:20
3/26/04 0:20
3/27/04 6:20
3/28/04 12:20
3/29/04 18:20
3/31/04 0:20

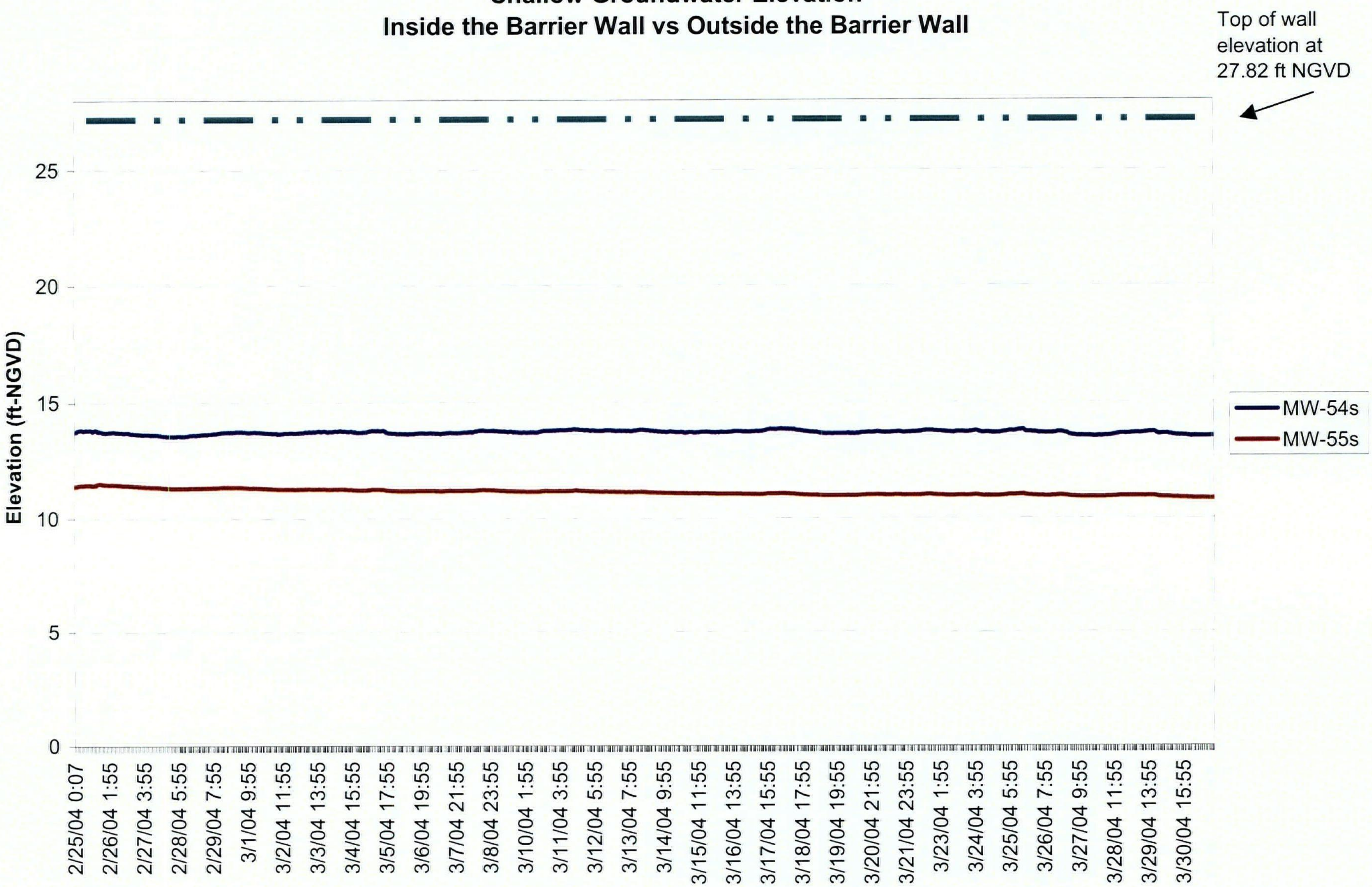
TFA Deep Groundwater Elevation
Inside the Barrier Wall vs Outside the Barrier Wall





Shallow Groundwater Elevation
Inside the Barrier Wall vs Outside the Barrier Wall
Top of wall elevation at 27.06 ft NGVD
Elevation (ft-NGVD)
25
20
15
10
5
0
MW-50s
MW-51s
2/25/04 0:59
2/26/04 6:48
2/27/04 12:48
2/28/04 18:48
3/1/04 0:48
3/2/04 6:48
3/3/04 12:48
3/4/04 18:48
3/6/04 0:48
3/7/04 6:48
3/8/04 12:48
3/9/04 18:48
3/11/04 0:48
3/12/04 6:48
3/13/04 12:48
3/14/04 18:48
3/16/04 0:48
3/17/04 6:48
3/18/04 12:48
3/19/04 18:48
3/21/04 0:48
3/22/04 6:48
3/23/04 12:48
3/24/04 18:48
3/26/04 0:48
3/27/04 6:48
3/28/04 12:48
3/29/04 18:48
3/31/04 0:48

Shallow Groundwater Elevation
Inside the Barrier Wall vs Outside the Barrier Wall



Willamette Cove Groundwater Elevation vs the Willamette River